STP 802.1d

- Timers
  - Advertised from Root
  - Hello
    - default 2
    - 1-10s
  - Forward Delay
    - default 15s
    - 4-30s
  - Max Age
    - default 20s
    - 6-40s
  - depends on Network Diamete
    - default 7
    - longest way between switches
  - () spanning-tree [vlan #id] (hello-time | forward-time | max-age) #s
- Root Bridge
  - lowest Bridge ID
    - Briudge Priority(2B)
      - default 32768
    - MAC
      - from SUP/Backplane
    - Traditional
      - 16bit priority
      - uniq VLAN-MAC
    - extended
      - 4bit priority
        - multibles of 4096
      - 12bit VLAN ID
      - nonuniq VLAN-MAC
      - ()spanning-tree extend system-id
  - Sends BPDUs
    - ()spanning-tree vlan#list priority #prio
    - config
      - ()spanning-tree vlan #id root (primary|secondary)
        - primary
          - lower than current Root
          - max 24576
          - doesn't set ID 0
        - secondary
          - 28672 fix
    - verify
      - sh spanning-tree [vlan #] root
      - sh spanning-tree [vlan #] bridge
- Bridge Protocol Data Unit
  - multicast 0180.c200.0000
  - Configuration BPDU
    - sent by Root Brige
    - Protocol ID
      - 0
    - Version
      - 0
    - Message Type
    - Flags
    - Root Bridge ID
    - Root Path cost
    - Sender Bridge ID
    - Port ID
    - Meesssage Age
    - Max Age
    - Hello Timer
    - Forward Delay
  - Topology Change Notification BPDU
    - On Topologiy Change
    - From Changed Switch to Root Bridge
    - no Data
    - Root Bridge
      - TC-Flag
        - change MAC-Ageout to forwared delay
- Port
  - Root Port
    - lowest root path cost
    - only one per Switch
    - Path to Root
  - Designated Port
    - one per Segment
    - switch with lowet Root Path cost
      - known from other BPDUS
  - costs
    - cumulative
    - on receiving
    - New STP Costs
      - 10Mbps 100
      - 100 Mbps 19
      - 1Gbps 4
      - 10Gbps 2
    - Tie Breakers
      - 1. lowest Root Brige ID
      - 2. lowest root path cost
      - lowest sender Bridge ID
      - 4. lowest sernder Port ID
    - config
      - (int) spanning-tree [vlan #id] cost #c
  - States
    - disabled
      - admin down
    - blocking
      - block data
      - receive BPDUs
    - listening
      - block Data
      - receive + send BPDUs
    - learning
      - block data
      - learn MAC-Addresses
    - forwarding
    - verify
      - debug spanning-tree switch state
      - sh spanning-tree int #int
  - Port ID
    - 8bit Port Priority
      - 128 default
      - (int) spanning-tree [vlan #id] port-priority #
    - 8bit Port Nr
      - fixed by architecture
- Types
  - Common STP
    - one instance for all VLANs
  - PVST
    - cisco propriateri
    - one instance per VLAN
    - requires ISL
  - PVST+
    - cisco proprietary
    - ISL + dot1q